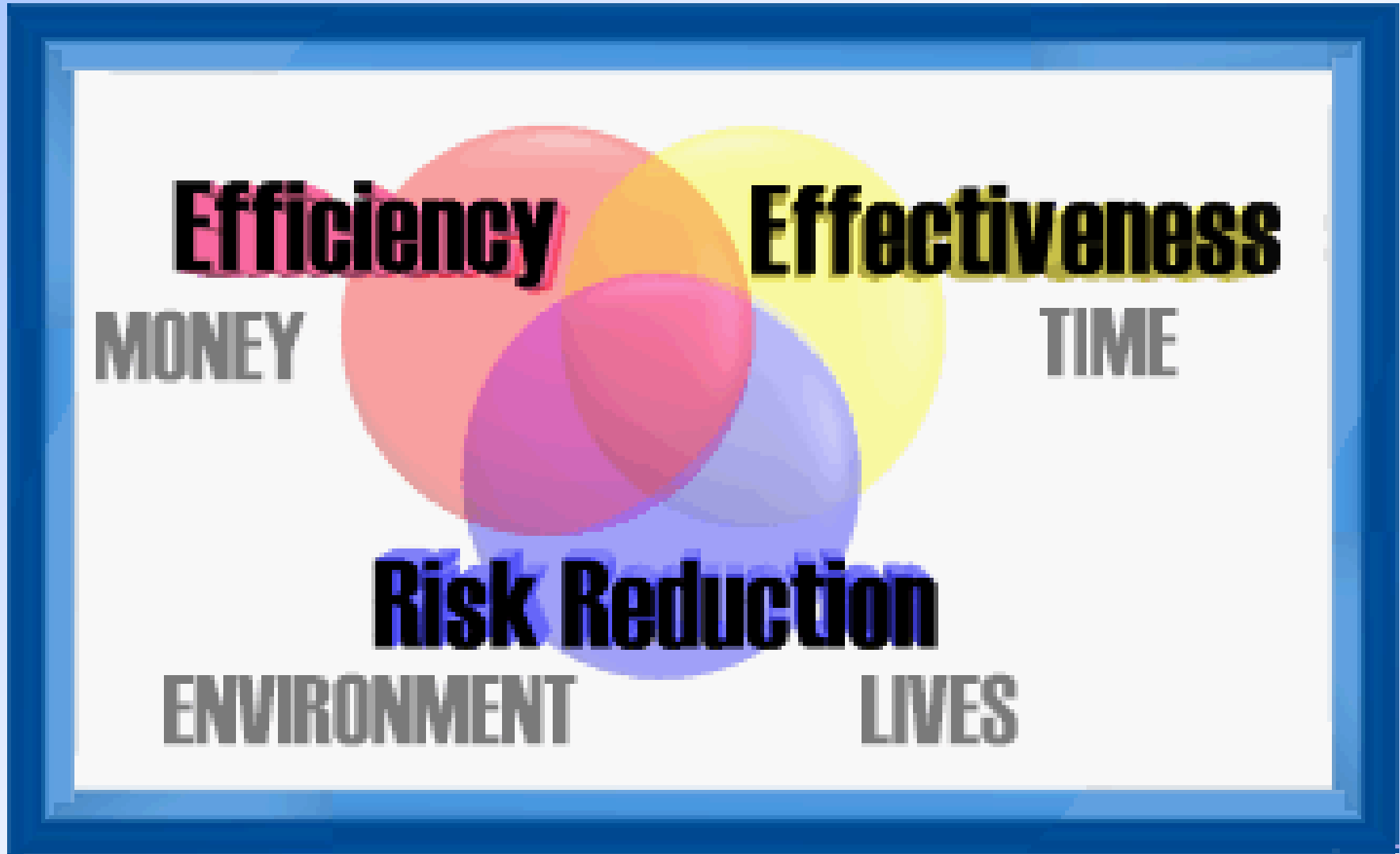




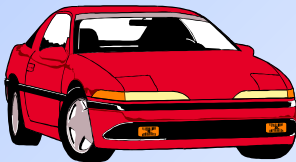
# ***Simulation--Return on Investment\****





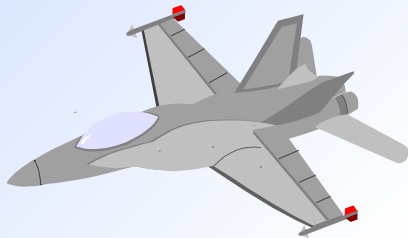
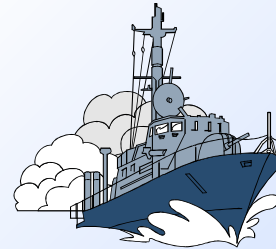
# *Simulation--Return on Investment*

**Efficiency = \$\$ Saved/Avoided**



\$75 Million Savings (Chrysler)

\$6 Million/100 Tons Savings (US Navy)



\$5 Billion Savings (US Air Force)

\$45 Million Savings (US Army)





# ***Simulation--Return on Investment***

## **Efficiency = \$\$ Saved/Avoided**

### **Apache Longbow Force Development Test & Evaluation**

| <b>Resources</b>         | <b>Phase I Manned Simulation</b> | <b>Phase II Field Test</b>   |
|--------------------------|----------------------------------|--|
| Cost(O&M)                | \$0.712M                         | \$4.049M   |
| Equipment                | 1 Simulator                      | 4AH-64D<br>2 UH-60<br>14 M1 Tanks<br>10 M3 Fighting Vehicles<br>2 2S6<br>20+ Air Defense Units<br>47+ Vehicles |
| Personnel (Government)   | 27                               | 663  |
| Mission Turn-Around Time | 2 Hours                          | 6 Hours  |
| Data Reduction Time      | 4 Hours                          | 80 Hours   |
| Number of Trials         | 32                               | 16   |
| Test Period              | 4 Weeks                          | 6 Weeks  |
| Safety                   | No Risk                          | Moderate Risk  |

\* Source: National Training Systems Association (NTSA)--[www.trainingsystems.org](http://www.trainingsystems.org)



# ***Simulation--Return on Investment***

**Efficiency = \$\$ Saved/Avoided**

**(Training Effectiveness Ratio (TER)  $\Rightarrow$  3 Sim Hrs = 1 Flt Hr  
for Approx. 60% of training tasks)**

| <b>System</b> | <b>Sim Hrs</b> | <b>Cost/Hr</b> | <b>Sim Cost<br/>(\$M)</b> | <b>TER Equivalent<br/>Flight Cost<br/>(\$M)</b> | <b>ROI</b> |
|---------------|----------------|----------------|---------------------------|---|------------|
| AH-64         | 47,840         | \$70.0         | \$3.3                     | \$49.3  | 15/1       |
| CH-47D        | 9,663          | \$256.0        | \$2.5                     | \$4.9   | 2/1        |
| UH-60         | 31,775         | \$56.0         | \$1.9                     | \$14.7  | 8/1        |



# ***Simulation--Return on Investment***

## **Effectiveness= Quality Improved**

### **Platoon Gunnery Target System (PGTS) Training:**

| <b>PGTS</b>                          | <b>Live-Fire</b>                |
|--------------------------------------|---------------------------------|
| Unlimited Targets to ID-Track-Engage | Limited Targets/Hit & Miss Only |
| Record/Playback of Missile & Target  | Hit & Miss video only           |
| Unlimited Choices of Terrains        | Fixed                           |
| Adjustable Weather Options           | Random                          |
| Target Size/Azimuth Variable         | Fixed, Limited Options          |

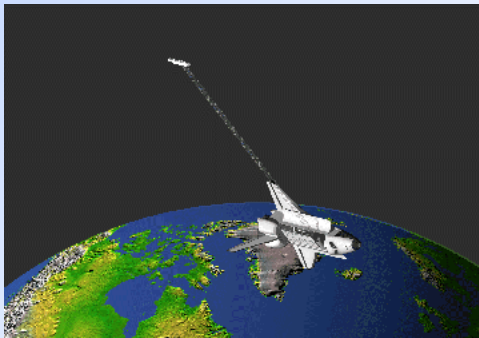
**Result:** Desert Storm--First Hits by PGTS-trained TOW gunners exceeded those not trained.  
(One USMC Crew hit ten for ten)



# *Simulation--Return on Investment*

## **Effectiveness= Quality Improved In Some Cases...**

- **Space Flight/Moon Landing**



- **Nuclear/Biological/Chemical**

**Scenarios**

**...Simulation is the ONLY  
Answer**





# ***Simulation--Return on Investment***

## **Effectiveness= Quality Improved In Others.....**

- **Vietnam War -- USN increase air combat exchange ratio  
from 2.4 to 12.5**
- **Navy Virtual Environment Firefighting -- 25% improvement  
in navigating the hull**
- **Aircraft Simulator Training**
  - **More practice against opposition aircraft (No schedule,  
logistics, range constraints)**
  - **Unlimited scenarios -- Immediate feedback**

**...It's Just the  
BEST**



# ***Simulation--Return on Investment***

## **Risk Reduction Lives, Property, Environment Saved**

- **Aircraft Simulators -- Significant role in reducing Navy accident rate**  
from 20/100K hours (1950s) to 2.39/100K hours (1989)
- **Gulf War**
  - **Simulation indicated only F-117 at low risk over Baghdad.**
  - Result: No aircraft lost**
  - **Simulation designed mission to avoid mid-air collisions**
- **“BURNSIM” Model replaced animals in aircraft life support**

**systems tests**


\* Source: National Training Systems Association (NTSA)--[www.trainingsystems.org](http://www.trainingsystems.org)





# Value of Modeling and Simulation

**Trained to an 20% System Capability**

|   |                              |   |
|---|------------------------------|---|
| <b>Costly</b>   | <b>Potentially Dangerous</b> | <b>Geographic &amp; Environment Constraints</b> |
|  | <b>Resource Intensive</b>    | <b>Lack of Shared Learning</b>                  |
| <b>Without Simulation</b>   |                              |   |

**Trained to an 80% System Capability**

|                        |  |  |
|------------------------|--|--|
| <b>With Simulation</b> |  |  |
|------------------------|--|--|

|  |          |             |            |
|--|----------|-------------|------------|
| <b>Helicopter Training (1.0 hrs)</b>                                     | \$       | \$ 125      | \$ 17 B    |
| <b>Increased Repetitions Increased Retention</b>                         |          |             |            |
| <b>Tank Gunnery Exercise</b>   | 175,000  | \$ 11       | @100k      |
| <b>25% Reduction in Target Acquisition</b>                               |          |             |            |
| <b>Environmentally Friendly</b>  |          |             |            |
| <b>Missile Performance Data Course</b>                                   | 1 Fire   | 15,000 DP's | \$ 7 M     |
| <b>Increased Accuracy of System</b>                                      |          |             |            |
| <b>Simulation Based Weapon Design Aircraft Part 5 DP's</b>               | 1200 hrs |             | @100k      |
| <b>Increased Lethality of System</b>                                     |          |             |            |
| <b>Comanche Prototype</b>  | 2000 hrs | \$20M       | Equal Cost |
| <b>Less Re-Work</b>  |          |             |            |
|  | \$500M   |             | Equal Cost |
| <b>40 % Reduction in Time to Production/Quicker Release to the Field</b> |          |             |            |

**\$ 480M**